Course Overview:

Nutritional and food science is a one-credit, interdisciplinary, elective course in which students gain an understanding of selected physical and life science concepts and apply them to every day life. Much of the study and work in this course is directed toward providing students with an understanding of concepts of nutrition and relationships between nutrition and science. Students use inquiry methods to conduct laboratory investigations. In addition, students explore career possibilities in science, nutrition, microbiology, family and consumer sciences, dietetics, and other research specialties.

Models are organized around guiding questions. Guiding questions direct teachers' choices of activities and are the questions students should be able to answer at the end of the course. Pages of models are arranged in pairs. On the left-hand page of each pair are guiding questions along with related academic expectations and correlations to the *Program of Studies* and nutritional and food science content chart. Sample activities and sample extensions for diverse learners are found on the right-hand page. While sample activities address *Program of Studies* content or content from elective areas, they are not intended to be comprehensive. Teachers still are responsible for planning instruction to meet the diverse needs of all their students.

Guiding Questions:

- What knowledge and skills are necessary to conduct scientific investigations in food science?
- How are nutrients used by the body?
- How is food energy used and stored in the body?
- What factors do microorganisms play in food preparation and decomposition?
- What careers are related to food science?

Academic Expectations	Content/Process
Scientific Ways of Thinking and Working, Patterns, Systems, Scale and Models, Constancy, and Change Over Time (2.1 - 2.6)	**Students will** • formulate procedures for food science experiments. • conduct scientific sensory evaluations of food. • identify chemical symbols most often seen in food science. • interpret basic science such as composition of matter, atomic structure, chemical formulas and equations, and chemical and physical changes in food. • identify properties of acids and bases. • test pH of common foods and food ingredients. • determine function of water in the human body and food preparation. • identify properties and composition of lipids, carbohydrates, proteins, vitamins, and minerals and how the body uses each. • analyze functions of enzymes. • analyze breakdown of food molecules. • examine chemical bonds of leavening agents. • analyze roles and interrelationships of microorganisms and food and analyze benefits and disadvantages of microbial action. • investigate uses of food additives. • explore career paths in nutritional science. • integrate activities of Family, Career, and Community Leaders of America (FCCLA) as an integral component of course content and leadership development. • apply math, science, and communication skills within technical content. • demonstrate employability and social skills relevant to the career cluster.

Academic Expectations	Guiding Questions	Correlations to the Program of Studies
Scientific Ways of Thinking and Working, Patterns, Systems, Scale and Models, Constancy, and Change Over Time (2.1 - 2.6)	**What knowledge and skills are necessary to conduct scientific investigations in food science?**	**Students will** **Physical Science** • investigate structure and physical properties of matter. • analyze atomic structure and electric forces. • investigate chemical reactions and energy. • examine the transfer of electrons or hydrogen ions between ions, molecules, or atoms. **Scientific Inquiry** • identify and refine questions and identify scientific concepts. • design and conduct different kinds of scientific investigations. • use equipment, tools, techniques, technology, and mathematics. • use evidence, logic, and scientific knowledge. • communicate designs, procedures, and results. • review and analyze scientific investigations. **Applications/Connections** • examine the interaction between science and technology. • explore the impact of science on personal and community health. • recognize that scientific knowledge is subject to change. **Nutritional Science Content Chart** • formulate procedures for food science experiments. • conduct scientific sensory evaluations of food. • interpret basic science such as composition of matter, atomic structure, chemical formulas and equations, and chemical and physical changes in food. • identify properties of acids and bases. • test pH of common foods and food ingredients. • apply math, science, and communication skills within

		technical content. • identify chemical symbols most often seen in food science.

Sample Activities	Sample Extensions for Diverse Learners
Students will • use scientific journals (e.g., *Scientific American*, *Science*) and Internet resources to investigate methods used to conduct and document results of scientific research. Discuss organizational format used in scientific research. • **design and conduct investigations to become familiar with measuring equipment and skills. Determine density of various substances. Compare volume measurements using various types of glassware (e.g., beaker, graduated cylinder). Compare masses using electronic and triple-beam balances. Organize data in tables. Graph mass versus volume measurements. Calculate slope to determine density. Explain in written laboratory reports differences in volume and mass measurements and explain why density may or may not be precise.** ***Technology suggestion:*** *Use integrated software package to create graphs.* • develop observation skills by participating in tasting parties to identify senses used to enjoy food. Compare taste, texture, color, smell, and shape of foods (e.g., low-fat varieties, convenience foods, home-cooked items). Rank foods in order of preference. Discuss significance of test results. Visit local restaurants and write critiques of foods' sensory appeal. Write articles to review restaurants' appeal to diners. *Use this activity to develop possible writing portfolio entries (WP Transactive).* See *Nutrition Curriculum Activities Kit Level 1* activitiesTasting Party Sensory Food Evaluation Lab See *Diet and Nutrition* activities Dare to Compare	Randy understands concepts at the same level as his peers. He has difficulty manipulating objects. For this activity, pair Randy with a peer for lab experiences in measuring. Each partner will be responsible for arriving at his own conclusions, based on raw data. Randy will audiotape his laboratory report *(Types of extensions: resources and materials, participation, demonstration of learning, level of support).*

Variety is the Spice of Life • explore physiological and emotional reasons for hunger. Survey peers to determine how emotions influence eating habits. Keep daily journals of meals and snacks to explain thoughts and feelings prior to eating. Analyze observations to determine patterns and identify emotional reasons for hunger. See *Diet and Nutrition Activities* activity Eating and Emotions	

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		technical content. • identify chemical symbols most often seen in food science.

Sample Activities	Sample Extensions for Diverse Learners
Students will • examine effects of advertising on food choices. Record types of foods shown on TV advertisements, length of ad time, and time of advertisement in graphic organizers. Plot results in circle graphs. Extend activity by using magazine ads. Create and videotape their own ads. Determine optimal viewing time to target appropriate markets. See *Diet and Nutrition Activities* activity Sense Appeal ***Technology suggestion:*** *Use integrated software package to create graphs.* • investigate physical and chemical properties and changes that occur during food preparation. Organize chemical parties. Make fudge, rock candy, no-bake cookies, and powdered, granulated drink mix to observe physical changes and bake cakes, fry eggs, and sour milk to observe chemical changes. Bring examples of elements, compounds, and homogeneous and heterogeneous mixtures to the party. Describe physical properties of items in cookbooks for other science classes. • investigate formation of chemical bonds during chemical changes. Create models of atoms and compounds commonly found in foods, showing bonds. Write time-period news articles about discovery of atoms and subatomic particles. ***Technology suggestion:*** *See http://ww.shef.ac.uk/chemistry/web-elements/index-fr.html.* • design and conduct investigations to determine pH of foods. Complete taste analysis of foods with different pH values and compare results of taste tests with peers. Create visual displays of foods with different pHs. Predict pH and describe properties of acids and bases of other foods. • design and conduct experiments to determine effects of cooking on pH of foods. Investigate how pH level of food influences food preservation techniques (e.g., canning, drying, freezing, pickling). Create multimedia presentations depicting optimum preservation techniques. • research causes and effects of abnormal levels of blood pH and tests used to determine blood pH. Discuss research on blood pH. Participate in discussions with dieticians to determine how foods affect blood pH. Extend activity to investigate effects of foods on blood sugar level. Interview people who must control sugar level in their diets.	

Academic Expectations	Guiding Questions	Correlations to the Program of Studies
Scientific Ways of Thinking and Working, Patterns, Systems, Scale and Models, Constancy, and Change Over Time (2.1 - 2.6)	**How are nutrients used by the body?**	**Students will** **Life Science** • investigate the cycle of atoms and molecules within the biosphere. • recognize that living systems require energy. **Scientific Inquiry** • identify and refine questions and identify scientific concepts. • design and conduct different kinds of scientific investigations. • use equipment, tools, techniques, technology, and mathematics. • use evidence, logic, and scientific knowledge. • communicate designs, procedures, and results. • review and analyze scientific investigations. **Applications/Connections** • examine the interaction between science and technology. • explore the impact of science on personal and community health. • analyze how science and technology are necessary for solving issues. • use science to investigate hazards. • recognize that scientific knowledge is subject to change. • investigate advances that have effects on science and society. • analyze the role science plays in every day life and compare different careers in science. **Nutritional Science Content Chart** • apply math, science and communication skills within technical content. • identify properties and composition of lipids, carbohydrates, proteins, vitamins, and minerals and how the body uses each. • determine function of water in the human body and food preparation.

Sample Activities	Sample Extensions for Diverse Learners
Students will • investigate nutrients (e.g., water, carbohydrates, lipids (fats), protein, vitamins) essential to sustaining life. Analyze food labels from common foods to determine nutrient content. Interview medical technologists to determine ways nutrients are measured in blood (e.g., normal ranges versus abnormal ranges). Visit local hospitals to explore ways nutritionists use diet to treat disease and maintain health. Compare current dietary recommendations to past recommendations. Develop informational brochures explaining how proper diets are essential for maintaining health. Distribute brochures through drugstores and hospitals *(WP-Transactive)*. See *Diet and Nutrition Activities* activities Food Guide Pyramid U.S. RDA Information Sheet Put the Label on the Table Label Able Understanding Food Labels See *Food Science Safety and Nutrition* activity Identifying Basic Components of Food • research community health problems associated with lack of clean water. Visit local water treatment plants to observe purification processes. Make small-scale models of water purification systems. Design and conduct investigations using common materials (e.g., charcoal) to purify water. Record data and findings. Write research articles for scientific journals outlining experimental procedures for purification experiments. Share experimental design with students in other schools. ***Technology suggestions:*** *Use CD-ROMs, digital cameras, computers, laser disks, video, and audio to create multimedia presentations. Share information via e-mail, Internet, or Kentucky's TeleLinking Network (KTLN).* • examine how carbohydrates (e.g., monosaccharides, disaccharides, polysaccharides) are used by the body. Taste test differences between natural sugars and artificial sweeteners. Describe diabetic (e.g., juvenile, mellitus) metabolism of carbohydrates. Develop one-	

day, balanced meal plans suitable for diabetics. Test for presence of carbohydrates (e.g., simple, complex) in foods. Discuss importance of carbohydrate loading prior to athletic events with athletic trainers. See *Food Science Safety and Nutrition* activities Structure of Carbohydrates Questions About Sugar and Sugar Labeling The Diet's Effect on Daily Activities	

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Sample Activities	Sample Extensions for Diverse Learners
Students will • investigate roles of lipids in the body. Identify two types of lipids (e.g., saturated, nonsaturated) in foods and the body. Test for presence of lipids (fats) in foods. Visit fast food restaurants and analyze fat content of foods using nutritional literature published by restaurant. Compare percentage of fat in fast foods with American Heart Association's recommendation for fat. Analyze data and create graphs of findings, share with class. Examine connections between saturated fat, cholesterol, and heart disease. Interview cardiologists to identify causes and effects of heart disease (e.g., arteriosclerosis, atherosclerosis, atherosis). Test fat content of different types of hamburger (e.g., 30% fat, 20% fat, 10% fat) from supermarkets, using solvents to remove fat from meat. Compare fat content to that listed on label. Prepare test tube displays showing percentages of fat content in foods. Develop menus using heart-healthy foods. ***Technology suggestions:*** *Use CD-ROMs, digital cameras, computers, laser disks, video, and audio to create multimedia presentations. Use integrated software package to create graphs.* • investigate roles of protein (e.g., complete, incomplete) in the body. Create diets that are nutritionally sound and use complete and incomplete proteins. Calculate number of calories from protein in diet. Present results of protein diets using multimedia sources. Compare vegetarian and nonvegetarian diets (e.g., lactovegetarian, pure vegetarian, ovolactovegetarian diet). Plan vegetarian diets that provide adequate protein. Analyze case studies to determine if Recommended Dietary/Daily Allowances (RDA) of protein are met. See *Nutrition Curriculum Activities Kit – Level 2* activities The Vegetarian Diet Complimentary Protein Relationships Complementing Your Proteins See *Nutrition Curriculum Activities Kit – Level 1* activities Nutrition Super Sleuth The Egyptian Connection Lost In Space See *Nutrition Curriculum Activities Kit – Level 1* activity All About Energy-yielding Nutrients: Protein	

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Sample Activities	Sample Extensions for Diverse Learners
Students will • investigate role of vitamins (e.g., fat soluble, water soluble) and minerals (e.g., macro, trace) in the body. Design and conduct investigations to distinguish between fat-soluble and water-soluble vitamins. Interview local pharmacists about vitamin and mineral supplements and outline major points of presentation, including benefits and hazards of using supplements. Visit pharmacy and compare U.S. Pharmacopoeia (USP) standards of different brands of multivitamins and cost of brands. Use integrated software package to analyze data and create bar graphs of USP standards of different brands. Research diseases (e.g., pellagra, beri beri, kwashiorkor, scurvy, rickets, night blindness, anemia) caused by lack of vitamins and minerals. Videotape oral presentations to share with other classes. See *Nutrition Curriculum Activities Kit - Level 1* activity All About Vitamins, Minerals, and Water See *Nutrition Curriculum Activities Kit - Level 1* activities The Case of the Volunteer Victims The Case of the Wobbling Hens ***Technology suggestion:*** *Use camcorders to videotape presentations.* • determine effects of exercise on loss or maintenance of weight. Predict future weight gain or loss if eating and exercise habits remain constant. Critique various exercise videotapes (e.g., "Sweatin' to the Oldies") to determine which burns the most calories. Research exercise programs offered to the public. Analyze fad diets (e.g., grapefruit diet, protein supplement drinks, fat-burner pills) for nutritional value. Investigate their relationships to eating disorders (e.g., anorexia nervosa, bulimia) and evaluate for safety. Discuss problems associated with eating disorders. Watch videos about eating disorders. Debate positive and negative effects media has on body image. Conduct school surveys to determine number of students who have dieted and types of diets used.	

Write articles for school newspapers encouraging positive weight control programs *(WP - Transactive).* See *Diet and Nutrition Activities* activity Diet Spy	

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Scientific Ways of Thinking and Working, Patterns, Systems, Scale and Models, Constancy, and Change Over Time (2.1 - 2.6)	**How is food energy used and stored in the body?**	**Students will** **Physical Science** • investigate chemical reactions and energy. • examine the transfer of electrons or hydrogen ions between ions, molecules, or atoms. **Life Science** • analyze energy flow through ecosystems. • recognize that living systems require energy. • analyze the flow of matter and energy. **Scientific Inquiry** • identify and refine questions and identify scientific concepts. • design and conduct different kinds of scientific investigations. • use equipment, tools, techniques, technology, and mathematics. • use evidence, logic, and scientific knowledge. • communicate designs, procedures, and results. • review, analyze scientific investigations. **Applications/Connections** • use science to analyze the use of natural resources. • examine the interaction between science and technology. • explore the impact of science on personal and community health. • analyze how science and technology are necessary for solving issues. • analyze the role science plays in every day life and compare different careers in science. • recognize that scientific

		knowledge is subject to change. **Nutritional Science Content Chart** • interpret basic science for food science such as composition of matter, atomic structure, chemical formulas and equations, and chemical/physical changes in food. • apply math, science, communication skills within technical content. • identify properties and composition of lipids, carbohydrates, proteins, vitamins, and minerals and how body uses each. • analyze functions of enzymes. • analyze breakdown of food molecules.

Sample Activities	Sample Extensions for Diverse Learners
Students will • examine how food is digested in the body. Draw or make models, labeling organs (e.g., mouth, esophagus, stomach, small intestine, gall bladder, liver, appendix, pancreas, large intestine) that are involved in the digestive process. Interview physicians and discuss disorders of the digestive system. See *Diet and Nutrition Activities* activities Breakdown As the Stomach Churns Liver, Gallbladder, and Pancreas • conduct interviews with family members or friends that have digestion problems (e.g., ulcers, acid reflux). Investigate contents of over-the-counter medications used to treat digestive problems. Design and conduct titrations to determine which over-the-counter remedies (e.g., Tums, Rolaids, Mylanta, Pepto-Bismol, Milk of Magnesia, baking soda) decrease pH of stomach acid. Document results of titration experiments and write summaries, defending best medications. • design and conduct experiments that compare substances that retard enzymatic browning of fruits (e.g., lemon juice, pectin). Record time-lapse enzymatic browning. Conduct blind taste tests comparing fresh fruit to fruit that has enzymatic browning. Determine effects fruit pH has on rate of enzymatic browning. ***Technology suggestion:*** *Use CD-ROMs, digital cameras, computers, laser disks, video, and audio to create multimedia presentations.* • record 3-day, food-intake in diary and 24-hour activity records (e.g., sleeping, studying, working, eating, exercising). Calculate basal metabolic rate (BMR), energy need, and energy output for one day. Complete case studies that examine factors (e.g., body size and composition, age, gender, environment, physiological state, personal life-style, pregnancy, infancy) affecting BMR, energy need, and energy output. See *Nutrition Curriculum Activities Kit- Level 2* activities Metabolism: Balancing Energy Input and Energy Output The Survival Mission What is the Energy Output? Case #1 What is the Energy Output? Case #2 What is the Energy Output? Case #3	

See *Diet and Nutrition Activities* activity Calories and BMR	

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Sample Activities	Sample Extensions for Diverse Learners
Students will • investigate foods containing each organic nutrient, describing its importance to the body. Examine importance of inorganic nutrients and their role as part of the diet. Create illustrated essays to explain chemical and physical processes of digestion. • investigate how cells store energy and how they use energy to carry out life activities. Research nutritional diets for different ages and activities. Determine total food energy value of selected diets. • examine energy sources for living systems. Construct models of energy containing food molecules (e.g., sugars, proteins). Construct models of simple molecules (e.g., CO_2, H_2O) from which food molecules are formed. Display models in classroom. • research methods used to determine number of calories in foods. Determine number of calories in walnuts by burning walnuts beneath small beakers filled with water. Compare water temperature before and after burning. Compare number of calories released by lipids, proteins, and carbohydrates. Write informational guides for dieters explaining which type of food provides most calories and why *(WP - Transactive).* • design food chains showing humans' position as primary and secondary consumers. Use food chains to construct food webs. Analyze humans' position in energy transfer. Compare vegetarian and nonvegetarian diets to determine effects of each on environment.	Mia has limited fine motor abilities, but her cognitive skills are commensurate with same age peers. She will need theraputty, rather than modeling clay, stiffer paper, larger objects. Peer or adult assistance constructing her models will be needed, but she should be allowed to perform construction of models herself. An occupational therapist will consult regarding appropriate types of materials *(Types of extensions: time, procedures and routines, resources and materials, level of support).*

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Scientific Ways of Thinking and Working, Patterns, Systems, Scale and Models, Constancy, and Change Over Time (2.1 - 2.6)	**What factors do microorganisms play in food preparation and preservation?**	**Students will** **Physical Science** • investigate chemical reactions and energy. • examine the transfer of electrons or hydrogen ions between ions, molecules, or atoms. **Life Science** • examine diversity and classification. • analyze the flow of matter and energy. **Scientific Inquiry** • identify and refine questions and identify scientific concepts. • use equipment, tools, techniques, technology, and mathematics. • design and conduct different kinds of scientific investigations. • communicate designs, procedures, and results. • review and analyze scientific investigations. **Applications/Connections** • examine the interaction between science and technology. • explore the impact of science on personal and community health. • recognize that scientific knowledge is subject to change. • recognize how science influences human population growth. • use science to investigate hazards. **Nutritional Science Content Chart** • interpret basic science for food science such as composition of matter, atomic structure, chemical formulas and equations, and chemical/physical changes in food. • apply math, science and communication skills within technical content. • analyze roles and interrelationships of microorganisms and food and benefits and disadvantages of microbial action. • investigate uses of food additives.

Sample Activities	Sample Extensions for Diverse Learners
Students will • examine types of food borne illnesses (e.g., salmonellosis, botulism, campylobacteriosis, listerosis, shigellosis, staphylococcal food poisoning) and microorganisms (e.g., *Salmonella*, *Clostridium botulinum*, *Campylobacter jejun*i, *Listeria monocytogens*, *Clostridium perfringens*, *Shigella*, *Staphylococcus aureus*) that cause illnesses. Research microorganisms beneficial to food preparation and preservation. Compare organisms that caused diseases in the past to disease causing organisms of today. Draw or make models of microorganisms that cause food-borne illnesses. Visit toxicology/microbiology labs. Tour food processing plants to observe tests for presence of microorganisms in food samples. Interview health safety inspectors on inspection standards (e.g., Food and Drug Administration (FDA), United States Department of Agriculture (USDA), state and local health agencies) that must be met by all food establishments. Interview school, food services coordinators to determine how safety standards are enforced. Report findings from interviews in school newspapers. Create brochures about food-safety standards and food-borne illnesses. Distribute at local supermarkets *(WP-Transactive).* See *Food Science Safety and Nutrition* activities Regulations That Protect Our Food Supply Food Products – Who Regulates Them? Safe Handling Beyond the Retail and Wholesale Shelf Bacteriological Examination of Food Equipment and Eating Utensils Bacteria in Milk – A Chemical Analysis The Unwelcomed Dinner Guest – Prevent Food Borne Illness Organisms That Bug You ***Technology suggestion:*** *Use integrated software packages to develop brochures.* • investigate food additives. Design and conduct experiments to determine efficacy (e.g., enhance flavor or color, aid processing or preparation, preserve quality, add nutritients) of additives. Research United States Department of Agriculture (USDA) and Food and Drug Administration (FDA) control over additives manufacturers use, including process followed to be included on FDA's Generally Recognized as Safe (GRAS) list.	

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Sample Activities	Sample Extensions for Diverse Learners
Students will • design and conduct skits that demonstrate effects of microorganisms on food. Use microscopes to view different kinds of microorganisms grown on food samples. Sketch microorganisms. Visit dairy processing plants to learn how microorganisms are essential for production of foods. Make yogurt for parents' night. See *Food Science Safety and Nutrition* activities Dairy Products Lab Making Yogurt Subsurface Mold Growth in Foods - Control of Molds in Bread Desirable Microbial Growth in Foods - Yeast Fermentation ***Technology suggestion****: Use flex cams or light microscopes to view microorganisms.* • compare methods of food preservation (e.g., canning, dehydration, freezing, irradiation, pickling). Investigate functions of additives (e.g., nutritive, preservative, quality-giving, cosmetic) in foods. Tour supermarkets and determine most common method of food preservation. Conduct taste comparisons of food preserved by different methods and report results to class. Observe cooperative extension agents demonstrating safe food preservation methods. Debate how improved food quality has affected human population growth. See *Food Science Safety and Nutrition* activities Effects of Light on Food Flavor Food Dehydration Frozen Foods Desirable Microbial Growth in Foods - Experimental Modification of Pickle Fermentation See *Diet and Nutrition Activities* activities Food Inspector What Is That Stuff? Additives or Preservatives? See *Nutrition Curriculum Activities Kit - Level 2* activities	

Chemical You Eat Food Label Tree To Add or Not To Add Fortified Foods See *Food Science Safety and Nutrition* activities Food Safety Risk Assessment - Additives Classes and Function Food Safety Risk Assessment - Nitrites and Nitrates in Meat Food Safety Decisions	

Academic Expectations	Guiding Questions	Correlations to the Program of Studies
Scientific Ways of Thinking and Working, Patterns, Systems, Scale and Models, Constancy, and Change Over Time (2.1 - 2.6)	**What careers are related to food science?**	**Students will** **Applications/Connections** • analyze the role science plays in everyday life and compare different careers in science. **Nutritional Science Content Chart** • apply math, science and communication skills within technical content. • explore career paths in nutritional science. • integrate activities of FCCLA as an integral component of course content and leadership development.

Sample Activities	Sample Extensions for Diverse Learners
Students will • investigate careers in food science (e.g., dietitian, nutritionist, bacteriologist, chemist, sensory evaluator) and food industries (e.g., quality assurance, production/operations management, product development, technical sales/service chef, cook, food processing plant employee, butcher, baker). Interview people in food-related careers (e.g., dietitian, cooperative extension agent). Compare different food science occupations with respect to potential income and career advancement. Prepare career day presentations comparing food science programs at post-secondary schools. Shadow chefs in hotels or restaurants. Develop informational articles on careers to distribute through school guidance offices *(WP-Transactive).* See *Food Science, Safety, and Nutrition* activity Careers in Food Science - Sensory Evaluation • participate in local, regional, state, and national FCCLA leadership conferences and competitions.	